



# Geospatial Technology in Support of Wildlife Law Enforcement

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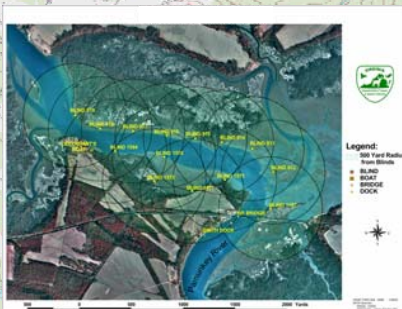


## Data Collection and Reporting

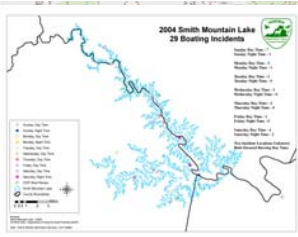
Out in the woods or on the water, law enforcement incidents cannot typically be referenced to a street address. Geographic or map coordinates, collected using Global Positioning System (GPS) receivers, are the best way to identify the locations features and events anywhere on the Earth. All Virginia game wardens are issued GPS units, typically Garmin Map76 units, and are trained on their use. GPS waypoints are being collected as part of routine reporting requirements.



Locations collected in the field can be combined with other spatial data, such as aerial photography, roads, topographic maps, hydrography, property boundaries, and jurisdictions. Using geographic information system (GIS) software, these data are analyzed, combined with derived information such as distances or buffers, and placed in custom map layouts. These maps can be powerful visualizations for communicating details to administrators or within court proceedings.



In the above map, a game warden collected GPS locations of a defendants boat, established duck blinds and other land marks. According to regulations, a person cannot hunt within 500 yards of an established duck blind. Using GIS to create 500 yard buffers around the blind locations, it was easy to communicate that the defendant was well within this distance of several blinds.



Geographic coordinates, obtained using a GPS, are required as part of any boating incident report. Maps created from these data can provide valuable feedback on boating trends, warden scheduling needs, and effectiveness of safety programs. Boating incident trends by type of watercraft, time of day, time of year, and seriousness of accident can be displayed by locations.

## Abstract

Geographic Information System (GIS) technology is playing an increasing role in law enforcement activities within the Virginia Department of Game and Inland Fisheries (VDGIF). All VDGIF game wardens are issued a Global Position System (GPS) receiver for recording geographic locations and for navigation. Certain incidents, such as boating accidents, require officers to report geographic coordinates along with other pertinent information. These spatial data allow DGIIF to analyze trends over time and space. All wardens have access to GIS software, hardware, and geospatial data such as high resolution aerial photography. Maps produced using GIS are increasingly being used as documents in court cases. These maps assist judges, attorneys, and jurors in visualizing the spatial relationships of a case. DGIIF is currently evaluating new spatial technology such as mobile GIS systems on handheld computers for use by wardens in the field. This poster displays and discusses the increasing and innovative use of GIS within wildlife law enforcement operations at VDGIF.

## Geospatial Resources

Beyond individual GPS units, law enforcements officers have access to ESRI's ArcGIS® software, geospatial data, and GIS/GPS training. The GIS office maintains GIS computer workstations at 5 VDGIF regional offices, headquarters, and 2 field offices. These computers contain extensive geospatial datasets, including topographic maps, DGIIF boat ramps and property boundaries, and high resolution aerial photography for all of Virginia. This photography is part of the Virginia Base Mapping Program. Introductory and intermediate GIS training courses are conducted 4 times per year. Selected law enforcement officers who have completed some training and are interested in using GIS, can have ArcGIS® software and geospatial data installed on their laptops. The GIS office supports GIS and GPS use throughout the agency.



## Crime Scene Tools

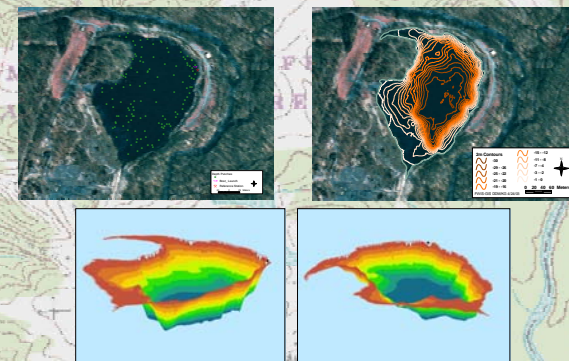
For critical law enforcement applications, such as crime scene investigation, VDGIF utilizes additional geospatial equipment. A high-end Trimble GeoXT GPS unit has the capability to record features with high accuracy. For many reporting needs, recreational grade Garmin GPS receivers, with 15 meter accuracy, are adequate. However, when precise locations are crucial, data from the Trimble GeoXT are post-processed to achieve the desired sub-meter accuracy.



The Law Enforcement Division utilizes a total station for all major forensic mapping incidents. The total station determines a distance and an angle between itself and a prism, establishing the spatial relationship between all relevant items, evidence and victims. Measurements are recorded and stored by a small data collector. Data are downloaded into a computer with crime scene mapping software and the finished maps are created. Detailed output from the total station can be combined with GIS data to obtain a complete picture of the crime scene.

## Bathymetric Mapping and 3-D Visualization

Mapping water depths and creating a 3-d image are important methods for visualizing a waterbody. Using a Trimble® GeoExplorer3 Global Positioning System (GPS) unit and a Hummingbird® depth finder mounted on the hull of a johnboat, VDGIF was able to map this quarry in 3-dimensions. GPS positions were recorded in 127 locations on the surface of the quarry. Positions were corrected using Trimble Real Time Correction (Beacon-on-a-Belt) to achieve sub-meter accuracy. Depth measurements were made at each GPS position. A 3-D geographic model was interpolated from the GPS positions and their associated depths using a process known as kriging in ESRI® 3-D Analyst® software. The model was used to estimate surface (2-D) area, total surface (3-D) area and volume of the quarry. Three-dimensional models and contour maps of the quarry bottom were generated using ESRI® ArcScene® software.



## Future use of GIS

VDGIF is currently investigating several ways geospatial technology will be integrated within law enforcement activities in the future. A Computer Aided Dispatch (CAD) system has recently been purchased for tracking incidents, calls, cases, and officers. Everything in the CAD system will have locational information. Mapping capabilities, including address geocoding will be integrated into the CAD system in the future. In the near-term, geographic coordinates are increasingly being recorded as part of routine incident reporting. Using these spatial data, data from other law enforcement agencies, the CAD system, and GIS software, VDGIF will have the capacity to perform wildlife crime analyses. Crime analysis will display spatial and temporal patterns of wildlife crime, providing critical information to managers and field officers. These data will also provide feedback on officer scheduling and for planning the location of the more efficient and effective patrols.



Providing access to crime analysis results, basic geographic data, and known offender databases to officers in the field is imperative. VDGIF is developing mobile GIS systems for law enforcement officers. These units consist of a handheld Microsoft Windows® CE computer (e.g. Hewlett-Packard iPAQ®), ESRI ArcPad® software, compact hard drives containing geospatial data, several crime databases, and a wireless GPS unit. Using these systems, officers can view detailed aerial photography and property boundaries of their location, query the location of past offenses in their work area, track their movements on a map, collect geospatial data, obtain driving directions, look up suspects in summons or warnings databases, and fill out forms. These systems will be a powerful tool for wildlife law enforcement in the Commonwealth.